CLAIMS

The invention claimed is:

1. A coupler comprising:

first and second conductive lines having at least first and second coupled sections of unequal length, and a delay section between the first and second coupled sections.

2. The coupler of claim 1 wherein the delay section has a length less than one-half the wavelength of an operating frequency.

3. The coupler of claim 2 wherein the delay section has a length between one-half and one-fourth the wavelength of the operating frequency.

4. The coupler of claim 2 wherein the delay section has a length of about one quarter wavelength of the operating frequency.

5. The coupler of claim 1 wherein the delay section has a length about equal to one-half the wavelength of an operating frequency less twice the electrical length of the first section.

6. The coupler of claim 1 wherein the lines have N coupled sections and N-1 delay sections, where N is an integer greater than two, and each of the N-1 delay sections is positioned between two coupled sections.

7. The coupler of claim 6 wherein at least two of the delay sections have unequal lengths.

8. The coupler of claim 1 wherein the delay section includes delay loops of equal lengths formed in both lines.

9. A coupler comprising:

a first conductive line extending between first and second ports; and

a second conductive line extending between third and fourth ports; the first and second conductive lines forming N coupled sections and N-1 uncoupled sections, where N is an integer greater than two, and each uncoupled section is positioned between two coupled sections.

10. The coupler of claim 9 wherein an uncoupled section includes an uncoupled loop formed in each of the first and second conductive lines.

11. The coupler of claim 10 wherein a portion of the first conductive line is a mirror image of a corresponding portion of the second conductive line.

12. The coupler of claim 9 wherein each of the uncoupled sections includes an uncoupled loop formed in each of the first and second conductive lines.

13. The coupler of claim 12 wherein the first conductive line is a mirror image of second conductive line.

14. The coupler of claim 13 wherein the coupler is a symmetrical coupler.

15. The coupler of claim 9 wherein adjacent coupled sections are spaced apart and an uncoupled section spans the space between the adjacent coupled sections, and the length of at least one of the uncoupled sections is about equal to one half of the wavelength of an operating frequency less the sum of twice the length of an adjacent coupled section.

16. The coupler of claim 9 wherein the first and second conductive lines are of unequal lengths in at least one uncoupled section.

17. The coupler of claim 16 wherein the first conductive line includes an uncoupled loop in the at least one uncoupled section.

18. The coupler of claim 17 wherein the second conductive line extends directly between the adjacent coupled sections in the at least one uncoupled section.

19. The coupler of claim 18 wherein the second conductive line extends directly between each of the N coupled sections.

20. The coupler of claim 19 wherein the N coupled sections extend in a line between a first coupled section and an Nth coupled section, and the second conductive line extends in a straight line between the first and Nth coupled sections.

21. The coupler of claim 9 wherein each of the coupled sections is less than one fourth of the wavelength of an operating frequency.

22. An asymmetrical directional coupler comprising:

first and second spaced-apart ground planes;

a substrate made of dielectric material mounted between the first and second ground planes;

a first conductive line mounted in the substrate between the first and second ground planes and extending between first and second ports; and

a second conductive line mounted in the substrate between the first and second ground planes and spaced from the first conductive line, the second conductive line extending between third and fourth ports; the first and second lines forming N coupled sections and N-1 uncoupled sections, where N is an integer greater than one, with each uncoupled section positioned between two coupled sections, wherein the coupled sections are not all of equal length and the uncoupled sections are not all of equal length.

23. The coupler of claim 22 wherein the ground planes are a distance apart, and each uncoupled section forms an open loop having a spacing between opposite portions that is at least the distance between the ground planes.

24. The coupler of claim 22 wherein the first and second conductive lines are of unequal lengths in at least one uncoupled section.

25. The coupler of claim 24 wherein the first conductive line includes an uncoupled loop in the at least one uncoupled section.

26. The coupler of claim 25 wherein the second conductive line extends directly between the adjacent coupled sections in the at least one uncoupled section.

27. The coupler of claim 26 wherein the second conductive line extends directly between each of the N coupled sections.

28. The coupler of claim 27 wherein the N coupled sections extend in a line between a first coupled section and an Nth coupled section, and the second conductive line extends in a straight line between the first and Nth coupled sections.

29. A quadrature hybrid coupler comprising:

first and second conductive lines symmetrically forming spaced-apart coupled sections, and an uncoupled section spanning the space between adjacent coupled sections, each uncoupled section being formed of equal uncoupled loops in the first and second lines.

30. The coupler of claim 29, wherein the coupled sections are of equal length, and the length of each of the uncoupled sections is substantially equal to one half of the wavelength of an operating frequency less twice the length of an adjacent coupled section.